K. T. Winther
7 Walnut Street
Upton, MA 01568-1101
508-529-0093
winther@charter.net

May 8, 2002

Commissioner for Patents
United States Patent and Trademark Office
Washington. D.C. 20231

Re: Application number 10/087,825
Application title: Bonding of parts with dissimilar thermal expansion coefficients
Applicant: Kaspar Tobias Winther

This letter is in response to the notice to file corrected application papers dated April 8, 2002. As requested, please find the revised drawing attached. In order to satisfy the requirement of reduced text in the drawing a few references should be inserted into the specification:

p. 4, line 4, change "together; these" to – together (1 and 3); these –
p. 4, line 13, change "layer that" to – layer 2, that –
p. 4, line 14, change "materials that" to – materials 1 and 3, that –

These changes are shown in red on the attached revised p. 4.

Very respectfully,

K. T. Winther

DETAILED DESCRIPTION OF THE INVENTION

Some of the preferred embodiments of the present invention are described here. The process will start by identifying the two (or more) materials to be bonded together (**1** and **3**); these materials can be of any kind, but would generally be solids belong to one of these groups: glasses, pure metals, alloys, semiconductor materials, ceramics, cermets, composites, inorganic polymers or organic polymers. A specific example could be a silicon die that is to be bonded to a sheet formed out of a specific alloy. Additional parameters that must be identified are the temperature range to which the bond will be exposed to, including the lock-in temperature during the bonding process, the coefficients of thermal expansion for the two (or more) materials in this temperature range and the desired physical characteristics of the system.

The second step is to identify the type of intermediary layer **2**, that will be used between the two materials **1** and **3**, that are being bonded. The selection will depend on required physical properties, including the thermal expansion coefficients. The intermediate layer could be fabricated out of glasses, pure metals, alloys, semiconductor materials, ceramics, cermets, composites, inorganic polymers or organic polymers. A specific example could be an intermediate layer of glass fabricated from two different types of glass that match the thermal expansion of silicon and the alloy to which this silicon is to be bonded, respectively. Based on the difference in thermal expansion coefficients between the materials (e.g. silicon and alloy), the anticipated temperature range and the modulus of elasticity of the glass the desired minimum thickness of the glass is estimated. Additional thickness will be added as a preventive measure and to account for the curved shape of the diffusion profiles and differences in diffusion among the various elements. If the two glasses, for example, differ in the content of sodium, potassium and boron known diffusion coefficients for these elements in the glasses are used as a basis for calculating the combination of time and temperature that would give suitable diffusion profiles. Changes in thermal expansion coefficients can be xpected to be a monotonous (although not necessarily linear) function of composition.

K. T. Winther
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winther@charter.net

May 29, 2002

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United States Patent and Trademark Office
Washington. D.C. 20231

Please find attached a corrected drawing that was submitted earlier. As I have not yet received the return postcard, that was attached, I am resubmitting the papers just in case they did not reach the Patent Office.

Sincerely,

K. T. Winther

K. T. Winther